

**Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554**

In the Matter of)	
)	
Use of Spectrum Bands Above 24 GHz For)	GN Docket No. 14-177
Mobile Radio Services)	
)	
Establishing a More Flexible Framework to)	
Facilitate Satellite Operations in the 27.5-28.35)	IB Docket No. 15-256
GHz and 37.5-40 GHz Bands)	
)	
Petition for Rulemaking of the Fixed Wireless)	
Communications Coalition to Create Service)	RM-11664
Rules for the 42-43.5 GHz Band)	
)	
Amendment of Parts 1, 22, 24, 27, 74, 80, 90, 95,)	
and 101 To Establish Uniform License Renewal,)	
Discontinuance of Operation, and Geographic)	WT Docket No. 10-112
Partitioning and Spectrum Disaggregation Rules)	
and Policies for Certain Wireless Radio Services)	
)	
Allocation and Designation of Spectrum for)	
Fixed-Satellite Services in the 37.5-38.5 GHz,)	
40.5-41.5 GHz and 48.2-50.2 GHz Frequency)	IB Docket No. 97-95
Bands; Allocation of Spectrum to Upgrade Fixed)	
and Mobile Allocations in the 40.5-42.5 GHz)	
Frequency Band; Allocation of Spectrum in the)	
46.9-47.0 GHz Frequency Band for Wireless)	
Services; and Allocation of Spectrum in the 37.0-)	
38.0 GHz and 40.0-40.5 GHz for Government)	
Operation)	

COMMENTS OF T-MOBILE USA, INC.

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TABLE OF CONTENTS

I.	Introduction And Summary	2
II.	The Commission Should Consider Authorizing Additional Millimeter Wave Bands	4
III.	Existing 28 And 39 GHz Licensees Should Be Authorized For Mobile Use And The Commission Should Auction The Remaining Spectrum	9
IV.	The 37 GHz Band Should Be Fully Licensed	12
V.	Some Of The 64-71 GHz Band Should Be Licensed	14
VI.	Additional Satellite Use Of The 28 And 39 GHz Bands Should Be Constrained.....	15
VII.	Licensing, Operating, Regulatory And Technical Issues For Licensed Millimeter Wave Spectrum.....	18
VIII.	Conclusion.....	21

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in the 37.0- 38.0 GHz and 40.0-40.5 GHz for)	
Government Operation)	

COMMENTS OF T-MOBILE USA, INC.

T-Mobile USA, Inc. (“T-Mobile”)^{1/} submits these comments in response to the October 23, 2015 Notice of Proposed Rulemaking (“NPRM”)^{2/} issued by the Commission in the above-

^{1/} T-Mobile USA, Inc. is a wholly-owned subsidiary of T-Mobile US, Inc., a publicly traded company.

referenced proceedings. The *NPRM* takes the first step in the important process of ensuring that additional spectrum resources are available to meet the deployment of fifth generation (“5G”) mobile wireless technologies. As the Commission continues this course, it should apply the allocation and licensing principles that have created today’s robust carrier networks.

I. INTRODUCTION AND SUMMARY

T-Mobile, including the MetroPCS brand, offers nationwide wireless voice, text, and data services to approximately 63 million subscribers.^{3/} T-Mobile continues to lead growth in the wireless industry, with 2.1 million net additions in the fourth quarter of 2015 – marking the eleventh consecutive quarter that T-Mobile has generated more than 1 million net customer additions and the third consecutive quarter with more than 2 million net customer additions.^{4/} Full-year 2015 also marked the second consecutive year that T-Mobile added more than 8 million net customers.^{5/} In addition, our network expansion is progressing at an accelerated pace. In fact, the footprint for our 4G Long-Term Evolution (“LTE”) network – the Nation’s

^{2/} *Use of Spectrum Bands Above 24 GHz For Mobile Radio Services; Establishing a More Flexible Framework to Facilitate Satellite Operations in the 27.5-28.35 GHz and 37.5-40 GHz Bands; Petition for Rulemaking of the Fixed Wireless Communications Coalition to Create Service Rules for the 42-43.5 GHz Band; Petition for Rulemaking of the Fixed Wireless Communications Coalition to Create Service Rules for the 42-43.5 GHz Band; Allocation and Designation of Spectrum for Fixed-Satellite Services in the 37.5-38.5 GHz, 40.5-41.5 GHz and 48.2-50.2 GHz Frequency Bands; Allocation of Spectrum to Upgrade Fixed and Mobile Allocations in the 40.5-42.5 GHz Frequency Band; Allocation of Spectrum in the 46.9-47.0 GHz Frequency Band for Wireless Services; and Allocation of Spectrum in the 37.0- 38.0 GHz and 40.0-40.5 GHz for Government Operations*, Notice of Proposed Rulemaking, 30 FCC Rcd. 11878 (2015) (“*NPRM*”). The *NPRM* set January 26, 2016 as the deadline for submitting comments in this proceeding. However, the Commission was closed then. These comments are being filed on the next business day. See 47 C.F.R. § 1.4(e)(1),(j).

^{3/} See T-Mobile News Release, *T-Mobile Adds Over 8 Million Customers for Second Consecutive Year* (Jan. 6, 2016), <https://newsroom.t-mobile.com/news/t-mobile-adds-over-8-million-customers-for-second-consecutive-year.htm>.

^{4/} See *id.*

^{5/} See *id.*

fastest 4G LTE network – more than doubled during 2015, expanding its reach to 304 million Americans.^{6/}

As T-Mobile previously noted and the growth described above highlights, identifying new spectrum for the provision of mobile services is, and will remain, vitally important for the wireless industry.^{7/} T-Mobile therefore applauds the Commission’s efforts. As multiple studies have shown, increasing use of data-intensive applications such as video and Internet access has created additional demand for carrier networks.^{8/} Spectrum above 24 GHz will play an important role in meeting that demand, in particular by meeting the small-cell needs that will increasingly be deployed in 5G networks.^{9/}

It is also essential that a substantial portion of any additional spectrum made available be available for licensed use. Deploying a network is a lengthy process involving standardizing a new frequency band, developing and certifying new equipment, acquiring sites, securing local permits and zoning, building infrastructure, and incorporating spectrum into consumer devices. Licensed operations help guarantee reliable service and encourage greater investment and technical innovation by providing carriers with needed certainty. T-Mobile therefore urges the Commission to adopt rules governing the millimeter wave bands, including for bands that were

^{6/} See *id.*

^{7/} Comments of T-Mobile USA, Inc., GN Docket No. 14-177, RM-11664, 2 (filed Jan. 15, 2015).

^{8/} See, e.g., CISCO, CISCO VISUAL NETWORKING INDEX: GLOBAL MOBILE DATA TRAFFIC FORECAST UPDATE, 2014–2019, at 17 (2015), http://www.cisco.com/en/US/solutions/collateral/ns341/ns525/ns537/ns705/ns827/white_paper_c11-520862.pdf (“Because mobile video content has much higher bit rates than other mobile content types, mobile video will generate much of the mobile traffic growth through 2019.”).

^{9/} Kelly Hill, *Exploring the Role of Small Cells in 5G*, RCR WIRELESS NEWS (Mar. 24, 2015), <http://www.rcrwireless.com/20150324/featured/small-cells-in-5g-tag6#prettyPhoto> (discussing statements by Nokia Networks, SK Telecom, the Next Generation Mobile Network Alliance, and Ericsson’s Radio Access Group stressing the importance of small cells for 5G networks).

not part of the *NPRM*, and to designate a significant amount of that spectrum for licensed operations.

In particular, T-Mobile suggests that the Commission take the following actions:

- Consider additional bands as part of this proceeding, particularly the 24 GHz bands, the 29/31 GHz bands, the 42-42.5 GHz band, and the 71-76/81-86 GHz bands.
- Authorize existing 28 GHz and 39 GHz licensees for mobile use.
- Grant new licenses in block sizes that take into consideration the amount of spectrum available in the band, the band's position in the spectrum and the opportunity for creating in-band competition.
- Fully license the 37 GHz band and harmonize the rules for this band with those for the 39 GHz band.
- Designate a portion of the 64-71 GHz band for licensed use.
- Limit further use of the millimeter wave bands by satellite stations.
- Consider eliminating construction-based performance requirements for licensees in the millimeter wave bands.
- Refrain from imposing interoperability requirements on mobile equipment operating in the millimeter wave bands.

II. THE COMMISSION SHOULD CONSIDER AUTHORIZING ADDITIONAL MILLIMETER WAVE BANDS

In the *NPRM*, the Commission uses four criteria to evaluate whether a millimeter wave band is suitable for mobile use: (i) the band should have at least 500 megahertz of contiguous spectrum; (ii) the band should ideally be under consideration internationally for millimeter wave mobile service; (iii) mobile use in the band should be compatible with existing incumbent licensees; and (iv) the band should be capable of supporting a flexible regulatory approach to accommodate a wide variety of services.^{10/} These four criteria unnecessarily limited the

^{10/} *NPRM* ¶¶ 20-24.

Commission’s consideration of other bands that may be usefully designated for future mobile allocations.

Specifically, the Commission’s 500 megahertz cut-off is overly restrictive and, as Commissioner Pai noted, artificial.^{11/} While larger spectrum blocks are preferable, there are some applications for which less spectrum may be useful.^{12/} For example, ultra-low latency machine-type communications applications require very low latency, but not all require high throughput. The Commission’s 500 megahertz cut-off is also inconsistently applied – the Commission rejects the 42 GHz, 32 GHz, 70 GHz, and 80 GHz bands even though they each have at least 500 megahertz of contiguous spectrum available.^{13/} Similarly, while internationally harmonized spectrum is useful, the Commission itself recently recognized that it may be necessary to designate spectrum on a regional basis.^{14/} Even spectrum for which there is currently no mobile allocation should be considered – the Commission may add a mobile allocation where not inconsistent with other uses.^{15/}

The process of making spectrum available takes many years, and therefore the Commission should begin working toward making more of these bands available now and not in

^{11/} *Id.* (statement of Commissioner Ajit Pai) (“[A] 500 MHz floor is artificial and backward-looking.”).

^{12/} *See id.* ¶ 16 (noting that Nokia suggested that 300 megahertz of contiguous spectrum was sufficient); *NPRM* (statement of Commissioner Ajit Pai) (“Nokia, which is doing a substantial amount of research into 5G, told the FCC that bands with as little as 300 MHz of contiguous spectrum could be useful sandboxes for wireless innovation.”).

^{13/} *See id.* (statement of Commissioner Ajit Pai) (“[The *NPRM*] claims, for example, that the agency is focusing only on bands with at least 500 MHz of spectrum. But the 42 GHz band offers 500 MHz. The 32 GHz band has 1,600 MHz. And the 70 and 80 GHz bands have 5 GHz of spectrum each!”).

^{14/} *See* World Radiocommunication Conference 2015, Presentation to the FCC Open Meeting (Dec. 17, 2015), http://transition.fcc.gov/Daily_Releases/Daily_Business/2015/db1217/DOC-336915A1.pdf (“Emerging trends from WRC-15: . . . Identifying spectrum on a regional basis may be more realistic.”).

^{15/} *See NPRM* (statement of Commissioner Ajit Pai) (noting that “nothing prevents [the Commission] from using this very proceeding to ink a mobile allocation for any band that lacks one”).

a later-initiated proceeding. As Commissioner O’Rielly noted, the Commission must work to include additional bands, “[e]ven if [the Commission is] not ready to determine every exact component” as this is “the only way [the Commission] will create the necessary spectrum pipeline for both future licensed and unlicensed use.”^{16/} Therefore, the Commission should consider those bands originally mentioned in the Notice of Inquiry,^{17/} those designated by the Inter-American Telecommunications Commission (“CITEL”) for consideration at WRC-15, and those designated at WRC-15 for additional study.^{18/} Notably, the following bands were recommended, but are not part of this proceeding: 23.15-23.6 GHz;^{19/} 24.25-27.5 GHz;^{20/} 28.35-29.5 GHz;^{21/} 31-31.3 GHz;^{22/} 31.8-33.4 GHz;^{23/} 40-40.5 GHz;^{24/} 40.5-42.5 GHz;^{25/} 42.5-43.5 GHz;^{26/} 45.5-47 GHz; 47.2-50.2 GHz; 50.4-52.6 GHz;^{27/} 57-64 GHz;^{28/} 71-76 GHz;^{29/} and 81-86 GHz.^{30/}

^{16/} *NPRM* (statement of Commissioner Michael O’Rielly).

^{17/} *See Use of Spectrum Bands Above 24 GHz for Mobile Radio Services*, Notice of Inquiry, 29 FCC Rcd. 13020 (2014) (“*NOI*”); *NPRM* ¶ 10.

^{18/} *See NPRM* ¶ 13; WORLD RADIOCOMMUNICATION CONFERENCE (WRC-15), PROVISIONAL FINAL ACTS, at 426 (2015), http://www.itu.int/dms_pub/itu-r/opb/act/R-ACT-WRC.11-2015-PDF-E.pdf.

^{19/} Recommended by CITEL.

^{20/} The 24.25-27.5 GHz band was recommended in full by CITEL and the International Telecommunications Union (“ITU”) at WRC-15. The 24.25-24.45 GHz and 25.05-25.25 GHz bands were recommended in the *NOI*.

^{21/} The 28.35-29.5 GHz band was recommended in full by CITEL. The 29.1-29.25 GHz band was recommended in the *NOI*.

^{22/} Recommended in the *NOI*.

^{23/} The 31.8-33 GHz band was recommended by CITEL and ITU. The 33-33.4 GHz band was recommended by ITU.

^{24/} Recommended by CITEL and ITU.

^{25/} The 40.5-42.5 GHz band was recommended by ITU. The 42.0-42.5 GHz band was recommended in the *NOI*.

^{26/} Recommended by ITU.

^{27/} Recommended by CITEL and ITU.

In view of the value of making more spectrum available for mobile wireless operations even when the spectrum does not meet all four of the Commission's criteria, T-Mobile questions the Commission's decisions to exclude the following bands from consideration as part of this proceeding:

- **24 GHz Bands.** According to the Commission, it excluded these bands because they do not have 500 megahertz of contiguous spectrum available – rather, there are two 200 megahertz blocks.^{31/} As noted above, however, not all use cases require 500 megahertz of spectrum. In addition, as the Commission correctly observes, protection of satellite links and lack of international harmonization are not insurmountable obstacles.^{32/}
- **29/31 GHz Bands.** Like the 24 GHz bands, the 29/31 GHz bands should not be eliminated from consideration merely because there cannot be 500 megahertz channels. Further, even if there are instances in which aggregating even 300 megahertz would be difficult in the 31-31.3 GHz band,^{33/} as millimeter wave technology matures, smaller bandwidths like 150 megahertz and 300 megahertz could prove much more effective than

^{28/} The 57-64 GHz band was recommended in full in the *NOI*. The 59.3-64 GHz band was recommended by CITEL.

^{29/} Recommended by CITEL and ITU and in the *NOI*.

^{30/} Recommended by ITU and in the *NOI*.

^{31/} See *NPRM* ¶ 65.

^{32/} See *id.* ¶ 65 (“This band also lacks an international mobile allocation; although we recognize that this could change in the future. We note that BSS feeder links in the upper part of the band are entitled to interference protection, and while not necessarily an insurmountable problem this would likely require complex analyses of the potential for aggregate interference from terrestrial wireless systems.”).

^{33/} See *id.* ¶ 70.

what may be attainable today. Also, as the Commission notes, it is possible to develop a sharing mechanism between the feeder links and mobile operations.^{34/}

- **42-42.5 GHz Band.** Although this band has 500 megahertz of contiguous spectrum, the Commission excluded it from the *NPRM* out of concern that “the need to protect the adjacent radio astronomy band at 42.5-43.5 GHz may require limits on the use of the band.”^{35/} While protecting radio astronomy operations may limit some uses, making the band entirely unavailable is unnecessary and may over-protect radio astronomy operations. Recent history suggests that commercial users can share with federal operations – and that even the agencies with the most sensitive communications requirements are willing to engage in sharing.^{36/} Therefore, the Commission should evaluate the appropriate protection levels – including through the use of guard bands – for radio astronomy and reconsider inclusion of this band. This 500 megahertz block could also be divided and used in smaller blocks.
- **71-76/81-86 GHz Bands.** As with the 42-42.5 GHz band, instead of rejecting the potential use of these bands for mobile operations, the Commission should evaluate rules

^{34/} See *id.* ¶ 70 (stating that “it could be possible to develop a sharing regime between the feeder links and mobile operations”).

^{35/} *Id.* ¶ 79.

^{36/} For instance, in the 3.5 GHz proceeding, the Commission adopted rules for shared commercial and federal use of the 3550-3700 MHz band, 100 megahertz of which (3550 MHz-3650 MHz) was previously allocated for Department of Defense radar systems. See *Amendment of the Commission’s Rules with Regard to Commercial Operations in the 3550-3650 MHz Band*, Report and Order and Second Further Notice of Proposed Rulemaking, 30 FCC Rcd. 3959 (2015). Similarly, in the AWS-3 proceeding, the Commission made 40 megahertz available for commercial use pursuant to collaboration between commercial and federal users. See *Amendment of the Commission’s Rules with Regard to Commercial Operations in the 1695- 1710 MHz, 1755-1780 MHz, and 2155-2180 MHz Bands*, Report and Order, 29 FCC Rcd. 4610 (2014) (“*AWS-3 Report and Order*”).

that would protect existing federal earth stations and fixed operations – the same type of protections that permit commercial use of other bands.

III. EXISTING 28 GHZ AND 39 GHZ LICENSEES SHOULD BE AUTHORIZED FOR MOBILE USE AND THE COMMISSION SHOULD AUCTION THE REMAINING SPECTRUM

The Commission should adopt its proposal to authorize existing 28 GHz and 39 GHz licensees for mobile use,^{37/} which is consistent with the existing use and allocation scheme and, as the Commission recognizes, is the most efficient and effective means of putting this spectrum into use for the benefit of consumers.^{38/} The Commission should *not* issue overlay licenses which may compromise the ability of existing licensees to make complete use of their licensed spectrum. To the extent that others value millimeter wave spectrum more than current license holders, the secondary market – in the form of transfers, assignments, partitioning and disaggregation – will ensure that the spectrum is put to use by those that value it the most.

The Commission proposes to license the 28 and 39 GHz bands on a county-basis.^{39/} Existing licensees would receive the number of county licenses that are equivalent to their current Basic Trading Area (“BTA”) or Economic Area (“EA”) licenses and new, auctioned licenses would cover a county only. As the Commission considers the appropriate geographic size for these bands, it should evaluate several competing factors. Because millimeter wave spectrum may at least initially be used to supplement capacity, providers may not need it in large geographic areas, making counties an appropriate license area. Similarly, licensing spectrum in smaller geographic areas, such as counties, will permit others access to the same spectrum in

^{37/} See *NPRM* ¶ 93.

^{38/} See *id.* ¶ 95 (“[T]his approach will minimize transaction costs and provide the fastest transition to expanded use of the band, which would be to the benefit of consumers.”).

^{39/} See *id.* ¶ 110.

adjacent areas from which they may be foreclosed if that spectrum is licensed as part of a larger geographic region. Nevertheless, creating county licenses will increase administrative burdens on licensees and the Commission – particularly if the Commission imposes performance requirements on a county basis for a licensee with hundreds of such authorizations. In addition to balancing these considerations, the Commission should also ensure that it uses geographic areas that are consistent with other terrestrial mobile licensing schemes. Providers should be able to secure licenses that conform to their current coverage footprints. And for those entities that wish to use 5G to meet both coverage and capacity requirements, the Commission should facilitate providers securing authorizations for multiple geographic areas.

While current licensees should retain the amount of spectrum for which they are authorized with the ability to aggregate where appropriate, there is no need for the Commission to retain its band plans for the 28 and 39 GHz spectrum for newly issued, auctioned spectrum.^{40/} Currently, the portion of the 28 GHz band that is the subject of the *NPRM* is licensed as a single 850 megahertz block.^{41/} That means there is generally a single local multipoint distribution service (“LMDS”) licensee per geographic area authorized to use that spectrum. This approach is inconsistent with most Commission mobile wireless licensing decisions, where it has created the opportunity for multiple licensees in a particular band.^{42/} While, as noted above, existing

^{40/} T-Mobile agrees with the Commission that new licenses should be issued for ten year terms and current licensees should be authorized ten year renewal terms.

^{41/} See *NPRM* ¶ 116; 47 C.F.R. § 101.1005.

^{42/} See, e.g., *AWS-3 Report and Order* ¶ 2 (“We will assign AWS-3 licenses by competitive bidding, offering 5 megahertz and 10 megahertz blocks[.]”); *Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions*, Report and Order, 29 FCC Rcd. 6567, ¶ 45 (2014) (“The 600 MHz Band Plan we adopt consists of paired uplink and downlink bands offered in 5+5 megahertz blocks.”); *Serv. Rules for the 698-746, 747-762 and 777-792 MHz Bands*, Second Report and Order, 22 FCC Rcd. 15289, ¶ 5 (2007) (“This band plan provides a balanced mix of geographic service area licenses and spectrum block sizes for the 62 megahertz of commercial spectrum to be auctioned.”).

licensees should retain their existing licenses with the authorization to provide mobile services, the Commission need not extend that band plan for the 28 GHz spectrum that the Commission will auction. Issuing a single license at auction is contrary to the public interest and limits competition in the band. Because of the unique characteristics of each of the millimeter wave bands, the Commission should not view a single 28 GHz license as completely substitutable for other spectrum and should create opportunities when it auctions the spectrum for more than one licensee to hold that spectrum.

While T-Mobile appreciates that larger spectrum block sizes are attractive for millimeter wave communications, those block sizes must be proportional to the amount of spectrum available, take into consideration a band's location in the spectrum and promote in-band competition where possible. Propagation characteristics require larger spectrum blocks in higher spectrum bands. For upper millimeter wave bands with a significant amount of available spectrum, the Commission can achieve both large block sizes and multiple licensees. However, at 28 GHz, with only 850 megahertz available, there should be smaller block sizes. As noted above, as 5G technology matures, smaller than 500 megahertz bandwidths will likely prove more effective than what might be achievable today. Thus, where the available bandwidth is more limited, as it is at 28 GHz and may be in other lower bands, smaller license blocks should be licensed in order to preserve competition.^{43/}

For the same reason, T-Mobile recommends that the Commission re-examine its proposal for 39 GHz, where 1.4 gigahertz of spectrum is available. In that band, the Commission can take

^{43/} T-Mobile has historically supported smaller block sizes to promote competition. *See, e.g.*, Comments of T-Mobile USA, Inc., GN Docket No. 13-185, 28 (filed Sep. 18, 2013) ("T-Mobile supports the Commission's proposal to license the AWS-3 spectrum using five megahertz blocks."). The block sizes that T-Mobile recommended in those bands were proportional to the recommended block sizes in this proceeding – taking advantage of the likely technology while preserving competition.

advantage of larger block sizes *and* license multiple entities in the band. In particular, the Commission’s proposed 39 GHz band plan does not take advantage of the potential use of wider bandwidths^{44/} – the very criterion the Commission found useful in selecting bands for consideration in this proceeding. The Commission should therefore consider licensing larger spectrum blocks in the 39 GHz band for new entrants.

IV. THE 37 GHZ BAND SHOULD BE FULLY LICENSED

For the 37 GHz band, the Commission has proposed to grant “local area” operating rights to premises occupants by rule, but to also license geographic areas for area wide use.^{45/} The Commission should *not* adopt this hybrid indoor/outdoor approach to the 37 GHz band. Instead, it should fully license the 37 GHz band and harmonize the rules for this band with those for the 39 GHz band. The Commission’s proposed approach is untested and may result in neither “local area” nor “wide area” licensees having effective use of the band.

The Commission’s plan has several technical and economic drawbacks. First, if the Commission were to grant spectrum rights to property owners, it would effectively leave wide area license holders with the spectrum that could only be used outdoors. However, because a significant percentage of spectrum and/or capacity needs are indoors, it would be very difficult for licensees to justify the investment in this band if indoor use was excluded. Second, even though propagation characteristics may limit radio signals’ range in this band, it is unrealistic to anticipate that transmissions generated indoors would simply stop before they left a building. Similarly, it is unrealistic to expect that signals generated for outdoor use could not be received indoors. It will therefore be challenging, if not impossible, to coordinate the outdoor and indoor

^{44/} See *NPRM* ¶ 117.

^{45/} See *id.* ¶ 100.

uses of the band. Further, Federal uses in the band can also be better accommodated with licensed use of the band. Federal uses currently include NASA receiving earth stations in the Space Research Service, National Science Foundation earth station operations, and military operations.^{46/} Licensed operations will provide a more stable, predictable environment in which to coordinate and implement protection measures.

Last, as the Commission notes, the 37 GHz band is adjacent to what will be a licensed 39 GHz band, creating opportunities to aggregate up to 3 gigahertz of contiguous spectrum.^{47/} Having that much contiguous spectrum will help drive innovation and significant economies of scale and scope for infrastructure across the combined bands, ultimately benefitting providers and consumers. In addition, 3 gigahertz of continuous bandwidth could support multiple large bandwidth licenses, such as six, 500 megahertz licenses, satisfying the twin goals of creating large spectrum blocks and multiple licensees in the combined band. The Commission should therefore harmonize the rules in these bands – including licensing the 37 GHz band with the same geographic license scheme as 39 GHz – to allow industry to develop use cases, deployment plans, and an equipment ecosystem for 5G that is interoperable across the entire 3 gigahertz. In any case, the Commission should consider the work that 3rd Generation Partnership Project performs in this and the other millimeter wave bands to ensure that its proposed band plans are consistent with those developed by international standards setting entities.

^{46/} See *id.* ¶ 48.

^{47/} See *id.* ¶ 51.

V. SOME OF THE 64-71 GHZ BAND SHOULD BE LICENSED

The Commission has tentatively proposed that the 64-71 GHz band be designated for unlicensed operations under Part 15 of the rules.^{48/} Because the 57-64 GHz band is currently designated for unlicensed use, adoption of the Commission’s plan would mean that there would be 14 gigahertz of contiguous unlicensed spectrum. As T-Mobile has stated many times, it is a leader in the use of unlicensed spectrum, which is a critical component of mobile networks, and agrees that it is important to make additional spectrum available for unlicensed operations.^{49/} Nevertheless, *the* critical component of mobile networks is licensed spectrum which, as noted above, grants providers the stable environment needed to encourage greater investment and technical innovation. Therefore, the Commission should evaluate the amount of spectrum that it is creating for unlicensed and licensed use, respectively, in this proceeding. Even if the Commission licenses the 37 GHz band, as T-Mobile suggests, there will be under 4 gigahertz of millimeter wave spectrum designated for licensed mobile wireless use in this proceeding, as opposed to an additional 7 gigahertz of spectrum (and 14 gigahertz overall) designated for unlicensed operations. The Commission should take a more balanced approach.

Designating some of the 64-71 GHz band for licensed use will also assist the development of the unlicensed portion of the band by promoting a common equipment

^{48/} See *id.* ¶ 58.

^{49/} Comments of T-Mobile USA, Inc., ET Docket No. 15-105, 2 (filed Jun. 11, 2015) (noting that “T-Mobile is an active supporter of unlicensed spectrum[,]” that “T-Mobile was the first carrier to offer its customers cutting-edge technologies like nationwide Voice over LTE . . . and next-generation Wi-Fi calling” and that T-Mobile’s “Wi-Fi Unleashed” program “ensures all new smartphones in T-Mobile stores are capable of Wi-Fi calling and texting and that all T-Mobile customers will be able to obtain a Wi-Fi calling and texting capable smartphone”); T-Mobile US, Inc. *Ex Parte*, ET Docket No. 15-105, 1 (filed Aug. 20, 2015) (discussing T-Mobile’s plans to deploy Long Term Evolution technology developed for use on unlicensed spectrum, T-Mobile’s industry leading use of Wi-Fi technology, and its strong commitment to ensuring that Wi-Fi remains robust).

ecosystem across the entire band. In particular, the Commission should designate the 64-66 GHz band for unlicensed operations, creating a 9 gigahertz block of spectrum with the existing 57-64 GHz band, and license the 66-71 GHz band. Such an approach would be consistent with the outcome of WRC-15.^{50/}

VI. ADDITIONAL SATELLITE USE OF THE 28 AND 39 GHZ BANDS SHOULD BE CONSTRAINED

The Commission has designated 850 megahertz at 27.5-28.35 GHz for LMDS on a primary basis and for FSS earth stations on a secondary basis.^{51/} In the 37.5-40 GHz band, FSS earth stations are primary, but may only be deployed if the FSS licensee obtains a 39 GHz license, or if it enters into an agreement with a 39 GHz licensee.^{52/} Additional use of the millimeter wave bands by satellite stations should be constrained, as such use would inhibit and complicate full use of the band for mobile terrestrial operations. While T-Mobile appreciates the Commission's goal of creating flexible spectrum use, the Commission must remain mindful of the primary goal of this proceeding – to create opportunities for terrestrial use of the millimeter wave band^{53/} – and the potential effect that incompatible spectrum uses can have on that goal.

^{50/} At WRC-15, the 66-76 GHz band was designated for additional study concerning use for the terrestrial component of International Mobile Telecommunications. The WRC-15 Provisional Final Acts note that the 66-76 GHz band already has allocations to the mobile service on a primary basis. *See* WORLD RADIOCOMMUNICATION CONFERENCE (WRC-15), PROVISIONAL FINAL ACTS, at 426 (2015), http://www.itu.int/dms_pub/itu-r/opb/act/R-ACT-WRC.11-2015-PDF-E.pdf.

^{51/} *See Rulemaking to Amend Parts 1, 2, 21, and 25 of the Commission's Rules to Redesignate the 27.5-29.5 GHz Frequency Band, to Reallocate the 29.5-30.0 GHz Frequency Band, to Establish Rules and Policies for Local Multipoint Distribution Service and for Fixed Satellite Services*, First Report and Order, 11 FCC Rcd. 19005, ¶ 45 (1996) (“At 27.5 - 28.35 GHz we designate 850 MHz for LMDS on a primary basis. GSO/FSS or NGSO/FSS systems will be permitted on a non-interference basis to the LMDS systems in the 850 MHz band segment, for the purpose of providing limited gateway-type services.”); 47 C.F.R. § 2.106; *see also* NPRM ¶ 124.

^{52/} *See* 47 C.F.R. §§ 2.106, 25.202(a)(1) n.3; NPRM ¶ 161.

^{53/} *See* NPRM ¶ 1 (“Today we take further steps to promote a flexible regulatory environment for the next generation of wireless services . . . In that regard, we identify specific spectrum bands above 24 GHz

28 GHz Band. T-Mobile agrees that the Commission may continue to permit secondary use of LMDS 28 GHz spectrum by FSS earth stations. However, as the Commission suggests, in order for satellite stations to enjoy primary protection the 28 GHz band, they must hold the same type of rights as terrestrial licensees. Doing so will provide both satellite uplink and terrestrial licensees in the 28 GHz band protection from inconsistent operations – both cannot operate in the same location with the same spectrum without causing harmful interference to each other. In order to secure those rights, they must participate in the auction of the spectrum or otherwise secure those rights in the secondary market from a current or future 28 GHz terrestrial license holder.^{54/} There is no basis for the Commission to permit current 28 GHz earth station operators – that have only secondary status today – to simply elect primary status. In contrast, existing terrestrial licensees already have primary status and a reasonable expectation that the Commission would allow mobile operations when the technology matured.^{55/} Any authorization of earth stations should continue to occur through the Part 25 licensing rules.^{56/}

that appear to be suitable for mobile service, and we seek comment on proposed service rules that would authorize mobile and other operations in those bands. This development of service rules for mobile use of the millimeter wave (mmW) bands occurs in the context of our efforts to develop a regulatory framework that will help facilitate so-called Fifth Generation (5G) mobile services.”).

^{54/} See *id.* ¶ 132.

^{55/} *Rulemaking to Amend Parts 1, 2, 21, and 25 of the Commission’s Rules to Redesignate the 27.5 GHz Frequency Band, to Reallocate the 29.5-30.0 GHz Frequency Band, to Establish Rules and Policies For Local Multipoint Distribution Service and For Fixed Satellite Services*, Second Report and Order, Order on Reconsideration and Fifth Notice of Proposed Rulemaking, 12 FCC Rcd. 12545, ¶ 207 (1997) (“Although LMDS is allocated as a fixed service, we know of no reason why we would not allow mobile operations if they are proposed and we obtain a record in support of such an allocation.”)

^{56/} See *NPRM* ¶ 134.

The Commission proposes several mechanisms that would permit greater secondary use of the 28 GHz band by satellite operations.^{57/} One of those is the potential use of a spectrum access system (“SAS”) for coordination between terrestrial licensees and satellite operators.^{58/} T-Mobile opposes this proposal. SAS remains an untested concept. While there are rules that permit its use in the 3.5 GHz band, there are no current SAS or similar database-driven operations.^{59/} Moreover, coordination between terrestrial and satellite uses will be difficult – for example, the Commission has assumed that millimeter wave base stations will have omnidirectional antennas,^{60/} which is not likely accurate – and an SAS will be unable to predict interference without knowing beamforming algorithms.

39 GHz Band. The Commission also seeks comment on whether it should establish a waiver process by which non-Federal FSS earth stations in the 39 GHz band could acquire co-primary status in those areas where there is no LMDS licensee if they can demonstrate that they would not have a negative impact on future terrestrial service.^{61/} As with the 28 GHz band, the Commission should not establish such a process. Instead, the Commission should retain the current rules requiring an FSS licensee to obtain a 39 GHz license in the area where an earth station will be located, or to enter into an agreement with the corresponding 39 GHz licensee, in order to deploy a gateway receive-only earth station.^{62/} In other words, if satellite licensees wish

^{57/} See *id.* ¶¶ 150-156 (proposing a spectrum access system-type mechanism, beacon signaling, or modifying existing limits on FSS transmissions toward the horizon as methods of facilitating sharing).

^{58/} See *id.* ¶ 150.

^{59/} See, e.g. 47 C.F.R. § 96.53 (describing the purposes and functionality of an SAS under the Citizens Broadband Radio Service rules); 47 C.F.R. § 96.1(a) (“The operation of all [Citizens Broadband Radio Service Devices] shall be coordinated by one or more authorized Spectrum Access Systems.”).

^{60/} See *NPRM* ¶ 152.

^{61/} See *id.* ¶ 162.

^{62/} See 47 C.F.R. §§ 2.106, 25.202(a)(1) n.3.

to secure interference protection for those stations on a co-primary basis, they should obtain the geographic area rights in an auction or the secondary market just as a terrestrial licensee would. Although there are currently no 39 GHz satellite operations, the rules permit their operation at certain established clear-sky power flux density (“PFD”) limits.^{63/} The rules contemplate that satellite users may increase power during heavy rain, however, there is no definition of that circumstance.^{64/} Satellite operators should not be allowed to increase their PFD limit during heavy rain, however it may be defined, as this too would add unnecessary complexity to, and unnecessarily constrain, terrestrial operations.

VII. LICENSING, OPERATING, REGULATORY AND TECHNICAL ISSUES FOR LICENSED MILLIMETER WAVE SPECTRUM

The Commission proposes various licensing, operating, regulatory, and technical rules for operations in the 28 GHz, 37 GHz, and 39 GHz bands. The Commission should not, however, adopt the performance requirements and all of the technical rules proposed.

Performance Requirements. The Commission’s proposal would require licensees to meet certain build-out requirements – in particular, a “licensee providing mobile or point-to-multipoint service [would have to] provide reliable signal coverage and offer service to at least 40 percent of the population in each of its county-based license areas at the end of the initial license term.”^{65/} Although this type of construction-based performance requirement may be usefully applied to current wireless broadband spectrum in lower bands, it is not appropriate for millimeter wave bands. Unlike lower band spectrum used for service coverage – the basis for most performance requirements – spectrum in the millimeter wave bands may be deployed to

^{63/} See 47 C.F.R. § 25.208(q).

^{64/} See 47 C.F.R. § 25.208(q) note; *NPRM* ¶ 165.

^{65/} *NPRM* ¶ 213.

supplement capacity and not necessarily as a stand-alone service. Moreover, it is currently unclear how use cases for these bands will develop. Thus, the performance requirements that traditionally apply to lower mobile wireless band licenses may not logically apply here. The Commission should therefore consider eliminating construction-based performance requirements.

Instead, the Commission may wish to consider, among other things, its proposal to reduce license terms with an option to re-acquire the license later at the auction price, adjusted for inflation,^{66/} but with some modifications to the proposal. Under the modified approach, licensees would be required to continue to pay for spectrum not in use as a “warehousing” fee. A licensee would not be required to continue to pay that fee if it were able to demonstrate, at the time of license renewal, that it was employing the spectrum, using whatever metric the Commission adopts. Similarly, a licensee could retain its authorization by paying the fee if it were unable to demonstrate performance to the standard that the Commission develops. Licensees would be required to assess the cost of continuing to hold an unproductive license against the benefit of having spectrum for later use.

Technical Rules. T-Mobile agrees that the Commission should adopt flexible rules that support separate transmit and receive bands to avoid unnecessarily directing technological development.^{67/} While Time Division Duplex will likely be the most prevalent use of the millimeter wave bands, the Commission has historically correctly adopted rules that are technologically neutral.^{68/} T-Mobile also generally supports the Commission’s proposal to

^{66/} See *id.* ¶ 221.

^{67/} See *id.* ¶ 269.

^{68/} See, e.g., *AWS-3 Report and Order* ¶¶ 104–105 (2014) (declining to impose an LTE interface standard in the AWS-3 spectrum because mandating a particular technology would “hamstring innovation

follow its PCS and AWS rules for base station power limits and antenna heights.^{69/} The Commission should not, however, require that mobile equipment operating within each millimeter wave band be interoperable across all air interfaces.^{70/} It is unclear how 5G technologies will develop – 5G air interfaces are still in the research phase, and there may be different air interface standards for different use cases. Imposing interoperability requirements across different technologies now will only hamper innovation. The Commission should instead allow standards to develop through an industry standards-setting process as the technologies progress.

and development and be contrary to the Commission’s policy to preserve technical flexibility and refrain from imposing unnecessary technical standards”) (quoting Reply Comments of T-Mobile USA, Inc., GN Docket No. 13-185, at 20–21 (filed Oct. 28, 2013)); *Implementation of Section 6002(b) of the Omnibus Budget Reconciliation Act of 1993 Annual Report and Analysis of Competitive Market Conditions With Respect to Mobile Wireless, Including Commercial Mobile Services*, Sixteenth Report, 28 FCC Rcd. 3700, ¶ 102 (2013) (stating “the Commission has adopted a general policy of providing licensees with significant flexibility to decide which services to offer and what technologies to deploy on spectrum used for the provision of mobile wireless services”); *Expanding Access to Broadband and Encouraging Innovation Through Establishment of an Air-Ground Mobile Broadband Secondary Service for Passengers Aboard Aircraft in the 14.0-14.5 GHz Band*, Notice of Proposed Rulemaking, 28 FCC Rcd. 6765, ¶ 101 (2013) (the FCC “strive[s] to establish technology neutral rules that allow for competing technologies and changes in technology over time without the need to change our rules”).

^{69/} See NPRM ¶¶ 274, 277.

^{70/} See *id.* ¶ 296.

VIII. CONCLUSION

T-Mobile appreciates the Commission's efforts to make additional spectrum available for mobile services. To exploit the full potential of the millimeter wave bands, the Commission should take the actions T-Mobile suggests above, including evaluating additional millimeter wave bands for mobile wireless use, designating a significant amount of millimeter wave spectrum for licensed operations, limiting further use of the millimeter wave bands by satellite stations, and eliminating construction-based performance requirements for these bands.

Respectfully submitted,

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